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Species

One new and three already known Myxosporean parasites of Indian major carps in Punjab (India)

Kaur H[1]☼, Dar SA[1], Singh R[1]

1. Department of Zoology and Environmental Sciences, Punjabi University, Patiala, Punjab-147002, India

☼***Corresponding author:*** Kaur H; Mail: - harpreet_bimbra@yahoo.com

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ABSTRACT

During the present study on myxozoan parasites of freshwater fishes of Punjab, 72 fishes were examined, 23 were found infected (31.94%). One new species i.e *Myxobolus basui* sp. nov. and three already known species *M. dossoui* Sakiti et al. (1991), *M. filamentosus* (Haldar et al. 1981) Gupta and Khera, 1988 and *M. saranae* Gupta and Khera (1990) were found infecting various organs such as gills, fins and scales of Indian major carps. Spores of the first species, *M. basui* sp. nov. measuring 13.33 x6.04µm, pyriform in shape with sharply pointed, spear-shaped anterior end and rounded posterior end. Polar capsules two, equal, elongated pyriform and measuring 6.57x1.66µm. Spores of the second species, *M. dossoui* Sakiti et al. (1991) measuring 5.78x4.16µm, having anterior end rounded and broad posterior end. Polar capsules two, pyriform with anterior end blunt and broad rounded posterior end equal sometimes unequal measuring 2.91x1.2µm and 2.08x1.25µm in size respectively. Spores of the third species, *M. filamentosus* (Haldar et al. 1981) Gupta and Khera, 1988 measuring 10.2x9.1µm rounded to oval in valvular view. Polar capsules two, anteriorly situated, subequal, pyriform and converge anteriorly measuring 3.6x1.6µm and 2.7x1.3µm in size respectively. Spores of the fourth species, *M. saranae* Gupta and Khera (1990) measuring 8.5x6.0µm, oval in valvular view having rounded anterior as well as posterior ends. Polar capsules two, unequal, oval to pyriform and slightly converge towards the anterior end measuring 4.27x2.61µm and 2.2x1.94µm in size respectively.

Keywords: - Aquaculture fish, Gills, India, Kanjali, *Myxobolus*

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1. INTRODUCTION

A large variety of fishes are vulnerable to various parasitic infections, out of which Myxozoa is emerging as a major group. Myxozoans are one of the economically important groups of microscopic metazoan parasites as they infect fish harvested for food. New myxosporean pathogens are continually emerging and threatening the development of pisciculture all over the world. The genus *Myxobolus* Bűtschli (1882) is one of the most intensely studied genus in the Phylum Myxozoa. These parasites can be found in every organ of a fish and have been known to cause serious disease in both wild and cultured fishes. Increased knowledge of molecular genetics and life cycle of myxozoans have shown that traditional descriptive characters (morphology, size, host tissue specificity) may be misleading (Bahri et al. 2003). In fact, spore morphology or tissue location of a given myxozoan may vary with the fish species and also due to environmental influences (Mitchell, 1989; Hedrick et al. 1999; Baldwin and Myklebust, 2002). Taxonomy of *Myxobolus* is difficult because the spores of many species resemble each other (Chen and Ma, 1998). Contemporary species descriptions address this issue by providing as much detailed information as possible on the spore and plasmodial structures (Eiras and D'Souza, 2004), ultrastructure (Ali et al. 2003; Tajdari et al. 2005), novel spore morphology (Eiras et al., 2005), pathology and nature of the infections (Longshaw et al. 2003; Levsen et al. 2004), sequence data of the 18S rDNA (Easy et al. 2005; Molnar et al. 2007, 2008, 2009; Ferguson et al. 2008) and ecological information on tissue and host specificity (Fomena et al. 2004; Molnar et al. 2007). Most authors now try to use as many of these features with sequence data, forming an integrated taxonomic assessment (Lom and Dykova, 2006; Szekely et al. 2009a, b).

2. MATERIALS AND METHODS

Fish specimens were procured from Mallumatra, Dhindsa ponds and Kanjali wetland of Punjab, freezed in ice-box and were brought to the laboratory for further investigation. The fishes were examined and dissected under the stereoscopic microscope. The organs examined were gills, liver, intestine, stomach, kidneys, gall bladder, scales and fins. Plasmodium was removed, teased on a clean microscopic slide and examined under the light microscope at 100X oil objective (Magnus inclined Trinocular microscope MLX-Tr) for the presence of myxospores. The fresh spores were treated with 8% KOH solution to evert the polar filaments. For permanent preparations, air dried smears were stained with Ziehl-Neelsen, Giemsa and Iron- haematoxylin. Identification up to generic level was done with the help of the key given by Kaur and Singh (2012). Complete description of the species was prepared according to the guidelines of Lom and Arthur (1989). The spore characteristics such as shape and size of the spores and polar capsules, presence or absence of an intercapsular process and iodinophilous vacuole etc were taken into consideration. The abbreviations used in the paper are as follows:- LS: Length of spore; WS: Width of

Table 1
Measurements (µm) and ratio of *M. basui* sp. nov.

Characters	Range	Mean Values	SD
LS	12.10-14.60	13.33	1.18
WS	4.68-7.40	6.04	0.78
LPC	6.14-7.02	6.57	9.42
WPC	1.0-2.3	1.66	0.89
Ratio: LS/WS		2.21	
ICP		absent	
NC		9-12	
Parietal folds		absent	

spore; LPC: Length of polar capsule; WPC: Width of polar capsule; ICP: Intercapsular process; TS: Thickness of shell valves; NC: Number of coils of polar filaments; SD: Standard deviation.

3. RESULTS AND DISCUSSION

3.1. SP. I: *Myxobolus basui* sp. nov. (Figures. 1a-c; 2ab; 3c)

3.1.1. Plasmodia

Minute, attached on the mucous membrane around gill lamellae. Spores 15-20 per plasmodium.

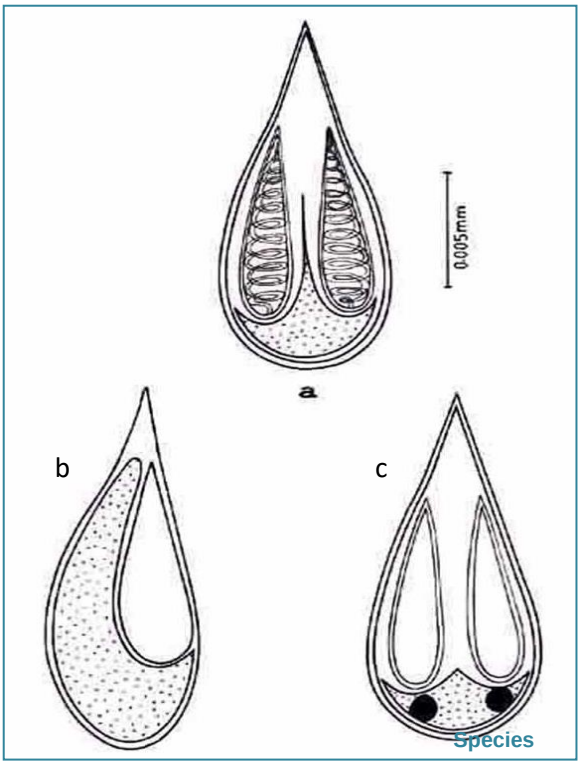

Figure 1
M. basui sp. nov.
a. Spore stained in Ziehl-Neelsen
b. Spore in side view
c. Spore stained in Iron-haematoxylin

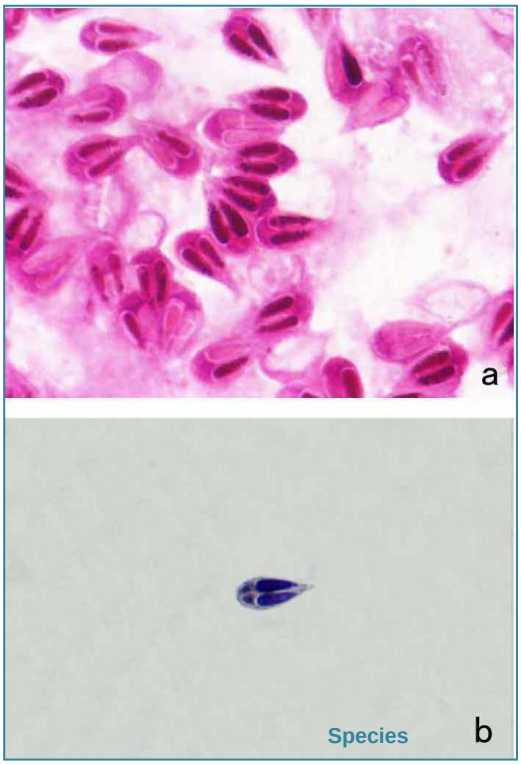

Figure 2
M. basui sp. nov.
a. Spore stained in Ziehl-Neelsen
b. Spore stained in Iron-haematoxylin

Figure 3
M. basui sp. nov.
c. Fresh Spore

3.1.2. Spore description

(Measurements based on 9-10 spores in frontal view), (Table 1)

The spores are histozoic, measuring 13.33 x6.04µm, pyriform with sharply pointed, spear-shaped anterior end and rounded posterior end. Maximum width at 11µm from anterior end. Shell valves smooth, symmetrical and thin walled measuring 0.50µm in thickness. Parietal folds absent. Polar capsules two, equal, elongated pyriform and measuring 6.57x1.66µm, in size positioned posteriorly from the tip of the spore and lie parallel to each other inside the spore body cavity. Polar filaments form 9-12 coils and are arranged perpendicular to the polar capsule axis in each polar capsule. An intercapsular process (ICP) absent. Sporoplasm agranular, homogeneous, hemispherical occupying rest of the spore body cavity. Sporoplasmic nuclei two measuring 0.33µm in diameter. An iodinophilous vacuole is absent.

3.1.3. Taxonomic summary of *M. basui* sp. nov.

Type host: *Cirrhinus mrigala* (Ham.) vern. mrigal
Type locality: Mallumatra Pond, Patiala, Punjab (India)
Material: Paratypes are spores stained in Ziehl- Neelsen and Iron-haematoxylin, deposited in the museum of

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Table 2
Comparative description of *M. basui* sp. nov. with morphologically similar species (measurements are in micrometer)

Species	Host	Site of infection	Locality	Spore size	Polar capsule size	Polar capsule (=or ≠)	Inter-capsular process (ICP)
***Myxobolus basui* sp. nov.(present study)**	*Cirrhinus mrigala*	Gills	Mallumatra Pond, Punjab (India)	13.33x 6.04	6.57x1.66	=	Absent
***M. catlae* Chakravaty (1943)**	*Catla Catla, Labeo rohita, C.mrigala*	Gills	West Bengal (India)	15.5x6.18	11.33x2.53	=	Absent
***M. beninensis* Sakiti et al. (1991)**	*Saratherodon melanotheron*	Gill arch, Connective tissue	Benin	10.5-14.0x5.5-x9.0	6.0-8.0-1.5-3.0	=	Absent
***M. longisporus* Nie and Li (1992)**	*Cyprinus carpio*	Gills	China	16.75× 6.75	7.8×2.0	=	Absent
***M. kribiensis* Fomena and Bouix (1994)**	*Brycinus longipinnis*	Skin, Eyes,Sclera	Cameroon	21.2x9.5	14.5-17.5× 3.0-4.0& 13.5-17.0x3-4	≠	Absent
***M. cuttacki* Haldar et al. (1996)**	*Cyprinus carpio*	branchial filaments	Orissa (India)	17.04 x6.48	8.64x2.8	=	Absent
***M. maculatus* Casal et al. (2002)**	*Metynnis maculates*	Kidney	Brazil	21×8.9	12.7×3.2	=	Absent
***M. rocatlae* Basu and Haldar (2002)**	*Catla catla* × *L. rohita*	Gut, Gills	West Bengal (India)	18.5×5.9	12.9×2.8 &11.3×2.2	≠	Absent
***M. catmrigale* Basu and Haldar (2004)**	*C. mrigala* × *Catla catla*	Gill filaments	West Bengal (India)	20.4× 16.3	11.9×2.3 & 11.0×2.3	≠	Absent
***M. bilobus* Cone et al. (2005)**	*Notemigonus crysoleucas*	Gills	Canada	21.0×8.4	10.8×2. & 10.1×2.8	≠	Absent
***M. shuleensis* Eiras et al. (2005)**	*Pseudorasbora parva*	Gills	China	16.1x9.0	7.1x3.0	=	Absent
***M. naini* Kaur and Singh (2008)**	*C. mrigala*	Gills	Kanjali wetland, Punjab (India)	12.9x8.2	4.9x3.1& 3.3x1.6	#	Small- sized
***M. eirasi* Kaur and Singh (2009)**	*C. mrigala*	Gills	Ropar and Kanjali wetland, Punjab (India)	8.6x6.7	3.2x1.57	=	Absent
***M. sciades* Azevedo et al. (2010)**	*Sciades herzbergii*	Gill lamellae	Brazil	9.15x4.36	4.44x1.63	=	Absent
***M. slendrii* Kaur and Singh (2010)**	*C. mrigala*	Gills	Ropar wetland, Punjab (India)	14.87x3.4	5.7x1.48	=	Absent
***M. harikensis* Kaur and Singh (2011c)**	*C. mrigala*	Caudal fin (in between rays fin)	Harike Wetland, Punjab (India)	10.1×8.5	5.0×3.1 & 1.7×1.4	#	Absent
***M. ropari* Kaur and Singh (2011a)**	*C .mrigala*	Gill lamellae	Ropar wetland, Punjab (India)	12.5x4.5	4.96x1.50	=	Medium-sized
***M. kalmani* Kaur and Singh (2011d)**	*C. reba*	gill lamellae (mucous membrane)	Harike wetland, Punjab (India)	10.0x4.7	3.4x1.67	=	Small-sized
***M. kanjali* Kaur and Singh (2011a)**	*C. mrigala*	Scales	Kanjali wetland, Punjab (India)	9.5x7.7	4.8x1.8	=	Absent
***M. mehlhorni* Kaur and Singh (2011b)**	*C. mrigala*	Gills	Harike Wetland, Punjab (India)	8.9 9 6.8	3.7x2.5 & 2.6x1.5	#	Absent
***M. myleus* Azevedo et al. (2012)**	*Myleus rubripinnis*	Gall bladder	Brazil	19.3x8.3	13.2x3.0	=	Absent

Table 3
Measurement (in µm) and ratio of *M. dossoui* Sakiti et al. (1991)

Characters	Range	Mean Values	SD
LS	4.67-6.85	5.78	0.85
WS	3.24-5.10	4.16	0.91
LLPC	1.96-3.84	2.91	0.87
WLPC	0.81-1.70	1.25	0.45
LSPC	1.89-3.06	2.08	0.45
WSPC	0.81-1.70	1.25	0.45
Ratio: LS/WS		1.38	
ICP		medium sized	
NC		4 in larger and 3 in smaller polar capsule	
Parietal folds		absent	

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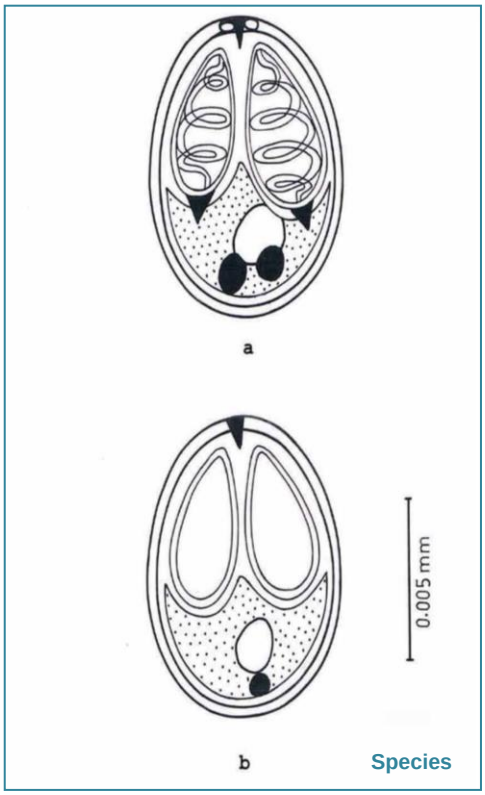

Figure 4

M. dossoui (Sakiti et al. 1991)
a & b. Spore stained in Ziehl-Neelsen (Valvular view)

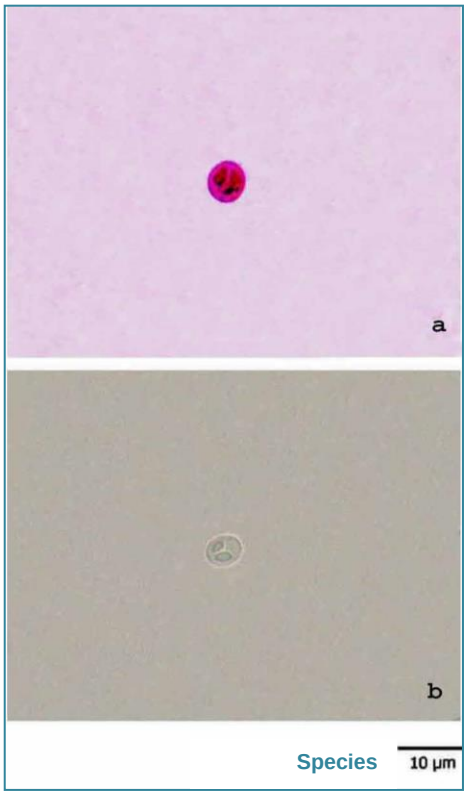

Figure 5

M. dossoui (Sakiti et al. 1991)
a. Spore stained in Ziehl-Neelsen
b. Fresh Spore

The pyriform shape of the spore with pointed anterior end and rounded posterior end brings it close to *M. cuttacki, M. rocatlae, M. catmrigale, M. bilobus, M. sciades, M. maculates, M. kribiensis, M. ropari* and *M. longisporus*. But spear-shaped anterior end of the spore of the present species under study differentiate it from the above mentioned species. Furthermore, *M. cuttacki* spores have a thickened notch in between two polar capsules, anterior end of spores are bluntly pointed in *M. rocatlae*, tear shaped in *M. catmrigalae* and anterior end is tapering into a knob-like ending in *M. sciades* and *M. maculates* spores. In addition, polar capsules are placed posteriorly from the tip of the spore and lying parallel to each other in the spore body cavity in spore under present study in contrast to convergent and anteriorly placed polar capsules in *M. cuttacki*, *M. longisporus* and *M. sciades.* Polar capsules are dissimilar with distinct neck region in *M. bilobus,* unequal in *M. kribiensis* and presence of intercapsular process in *M. ropari* demarcate all of the above species from the present species under study. In light of the above differences, the species under study has been considered as new to the science and named as *M. basui* sp.nov. through this communication.

3.2. SP. II: *M. dossoui* Sakiti et al. (1991) (Figures 4ab; 5ab)

3.2.1. Plasmodia

Minute attached on the mucous membrane around gill lamellae. Spores are 5-8 per plasmodium.

3.2.2. Spore description

(Measurements based on 8-13 spores in frontal view), (Table 3)

The spores are histozoic, oval to rounded in valvular view, measuring 5.78x4**.**16µm having anterior end rounded and broad posterior end. Shell valves thick, smooth, symmetrical and measuring 0.67µm in thickness. Parietal folds absent. Polar capsules two pyriform with anterior end blunt and broad rounded posterior end, equal sometimes unequal. Both polar capsules converge anteriorly and diverge apart posteriorly, each having an independent opening. Larger polar capsule measuring 2.91x1.25µm and smaller one measuring 2.08x1.25µm in size. Polar filaments form 4 coils in larger and 3 in smaller polar capsule arranged perpendicular to the polar capsule axis. An intercapsular process (ICP) medium-sized, triangular in shape. Sporoplasm agranular, homogenous having two sporoplasmic and two capsulogenic nuclei, each measuring 0.50µm and 0.17µm in diameter respectively. An iodinophilous vacuole measuring 3.33µm in diameter is present.

3.2.3. Taxonomic summary

Host: *Cirrhinus mrigala* (Ham.) vern. mrigal
Locality: Dhindsa pond, Patiala, Punjab (India)
Site of infection: Gills
Prevalence of infection: 81.25% (13/16)
Symptoms: Mucous laden gills

3.2.4. Remarks

The observations on the specimens of *M. dossoui* Sakiti et al. (1991) under study were in conformity with the original description except for some minor variations in the size of the spore, polar capsules and number of coils. Both the polar capsules contain 4 and 3 number of coils in comparison to the original specimens having 8 and 5 number of coils. Two prominent openings were present at the anterior end of the spores under study. Earlier, this

Department of Zoology, Punjabi University, Patiala, (India), slide no. M/ZN/26.12.2011 and M/IH/26.12.2011
Site of infection: Gills
Prevalence of infection: 19.35% (6/31)
Pathogenicity: Non pathogenic
Etymology: The specific epithet *basui* has been given after the name of Dr. Saugata Basu, an eminent worker in the field of Protozoology in India.

3.1.4. Differential diagnosis

The present species was closely compared with *M. catlae* Chakravarty (1943) from gills of *C. mrigala*, *M. beninensis* Sakiti et al. (1991) from gill arch and connective tissue of *Saratherodon melanotheron, M. longisporus* Nie and Li (1992) from gills of *Cyprinus carpio*, *M. kribiensis* Fomena and Bouix (1994) from skin and eye-sclera of *Brycinus longispinnis*, *M. cuttacki* Haldar et al. (1996) from branchial filaments of *Cyprinus carpio*, *M. maculatus* Casal et al.(2002) from kidneys of *Metynnis maculatus*, *M. rocatlae* Basu and Haldar (2002) from gills and gut wall of *Catla catla* x *Labeo rohita* hybrid, *M. catmrigale* Basu and Haldar (2004) from gill filaments of *Catla catla* x *C. mrigala* hybrid, *M. bilobus* Cone et al. (2005) from gill filaments of *Notemigonus crysoleucas, M. shuleensis* Eiras et al. (2005) from gills of *Pseudorasbora parva*, *M. naini* Kaur and Singh (2008) from gills of *C. mrigala, M. eirasi* Kaur and Singh (2009) from gills of *C. mrigala, M. sciades* Azevedo et al. (2010) from gill lamellae of *Sciades herzbergi, M. slendrii* Kaur and Singh (2010) from gills of *C. mrigala, M. harikensis* Kaur and Singh (2011c) from caudal fins of *C. mrigala*, *M. ropari* Kaur and Singh (2011a) from gill lamellae of *C. mrigala*, *M. kalmani* Kaur and Singh (2011d) from gill lamellae of *C. reba, M. kanjali* Kaur and Singh (2011a) from scales of *C. mrigala, M. mehlhorni* Kaur and Singh (2011b) from gills of *C. mrigala* and *M. myelius* Azevedo et al. (2012) from gall bladder of *Myleus rubripinnis,* but differed from all of the above in morphological and morphometric characteristics (Table 2).

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Table 4
Comparative description of *M. dossoui* Sakiti et al. (1991) with the original species (measurements are in micrometer)

Species	Host	Site of infection	Locality	Spore	Polar capsules
***M. dossoui* (present study)**	*Cirrhinus mrigala*	Gills	Dhindsa pond, Patiala (India)	5.78x4.16	2.91x1.25 and 2.08x1.25
***M. dossoui* Sakiti et al. (1991)**	*Tilapia zillii*	Gill arches, cartilage	Benin (West Africa)	9.9x9.2	5.5x4.25 and 3.75x2.75

Table 5
Measurements (in µm) and ratio of *M. filamentosus* (Haldar et al. 1981) Gupta and Khera, (1988)

Characters	Range	Mean Values	SD
LS	10.0-10.4	10.2	0.28
WS	8.9-9.3	9.1	0.28
LLPC	3.2-4.0	3.6	0.56
WLPC	1.0-2.2	1.6	0.84
LSPC	2.4-3.0	2.7	0.42
WSPC	1.0-1.6	1.3	0.42
Ratio: LS/WS		1.1	
ICP		absent	
NC		5-6 in larger and 3-4 in smaller polar capsule	
Parietal Folds		absent	

Table 6
Comparative description of *M. filamentosus* (Haldar et al. 1981) (Gupta and Khera, 1988) with original species (measurements are in micrometer)

Species	Host	Site of infection	Locality	Spore	Polar capsule
M. filamentosus (present study)	*Labeo Calbasu*	Scales	Kanjali wetland, Punjab (India)	10.2x9.1	3.6x1.6 and 2.7x1.3
M. filamentosus (Haldar et al. 1981), (Gupta and Khera, 1988)	*Puntius filamentosa*	Cartilage, brain	West Bengal (India)	13.7x9.5	5.8x3.1

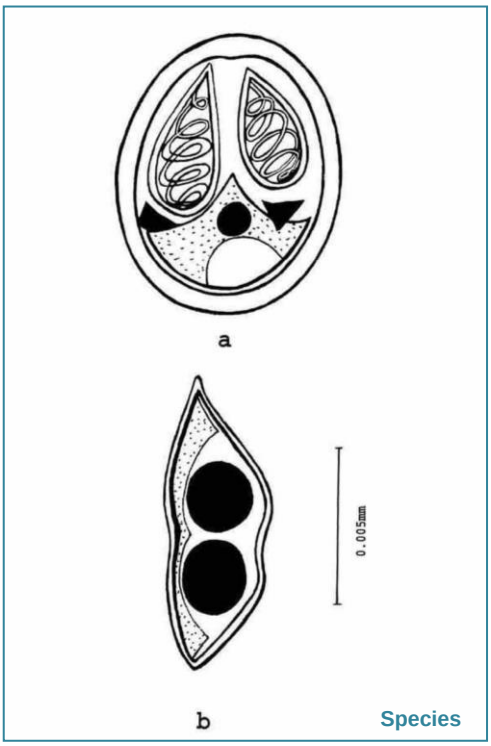

Figure 6
M. filamentosus (Haldar et al. 1981)
a. Spore stained in Ziehl-Neelsen (Valvular view)
b. Spore stained in Ziehl-Neelsen (Side view)

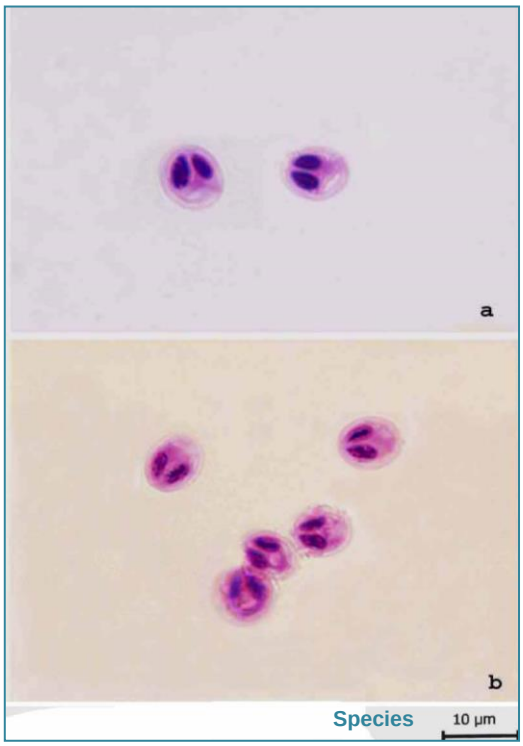

Figure 7
M. filamentosus (Haldar et al. 1981)
a & b. Spore stained in Ziehl-Neelsen

parasite was recorded from Benin (West Africa) infecting gill arches and cartilage of *Tilapia zillii*. *M. dossoui* has been recorded for the first from India. A new host- *C. mrigala* and a new locality–Dhindsa pond, Punjab (India) has been recorded for this parasite (Table 4).

3.3. SP. III: *M. filamentosus* (Haldar et al. 1981) Gupta and Khera, 1988 (Figures 6ab; 7ab)

3.3.1. Plasmodia

Pale yellow to milky-white, present all over scales, 2-3 in number and measure 0.9-1.5 mm in diameter. 15-20 spores are present per plasmodium.

3.3.2. Spore description

(Measurements based on 12-14 spores in frontal view), (Table 5)
The spores are histozoic, measure 10.2x9.1µm and are rounded to oval in valvular view. Shell valves are thick, smooth, symmetrical and measure 0.6µm in thickness. Parietal folds are absent. Polar capsules are two, anteriorly situated, subequal, pyriform and converge anteriorly. Larger polar capsule measure 3.6x1.6µm and smaller one is 2.7x1.3µm in size. Anterior end of both the polar capsules is pointed and rounded posteriorly occupying half of the spore body cavity. Polar filaments form 5-6 coils in larger and 3-4 in smaller polar capsule and are arranged perpendicular to polar capsule axis. An intercapsular process is absent. Two capsulogenic nuclei are present beneath each polar capsule measuring 1.1µm in diameter. Sporoplasm is agranular, homogenous and occupy whole of the extracapsular space behind the polar capsules. Sporoplasmic nucleus one, measuring 1.5µm in diameter. An iodinophilous vacuole is present measuring 3.1µm in diameter.

3.3.3. Taxonomic summary of *M. filamentosus* (Haldar et al. 1981) Gupta and Khera, 1988

Host: *Labeo calbasu* (Ham.) vern. kalbans
Locality: Kanjali wetland, Punjab, India
Site of infection: Scales
Prevalence of infection: 20% (2/10)

3.3.4. Remarks

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Table 7
Measurements (µm) and ratio of *M. sarane* Gupta and Khera (1990)

Characters	Range	Mean Values	SD
LS	8.0-9.0	8.5	0.70
WS	5.5-6.5	6.0	0.70
LLPC	3.97-4.57	4.27	0.42
WLPC	2.31-2.91	2.61	0.42
LSPC	1.9-2.5	2.2	0.42
WSPC	1.74-2.14	1.94	0.28
Ratio: LS/WS		1.4	
ICP		absent	
NC		5-6 in larger and 2-3 in smaller polar capsule	
Parietal Folds		absent	

Table 8
Comparative description of *M. saranae* Gupta and Khera (1990) with original species (measurements are in micrometer)

Species	Host	Site of infection	Locality	Spore	Polar capsule
M. saranae (present study)	*Labeo rohita*	Caudal fin	Kanjali wetland, Punjab (India)	8.5x6.0	4.27x2.61 and 2.2x1.94
M. saranae Gupta and Khera (1990)	*Puntius saranae, L. calbasu*	Gills	Punjab (India)	7.72x6.2	4.424x3.04 and 1.98x1.3

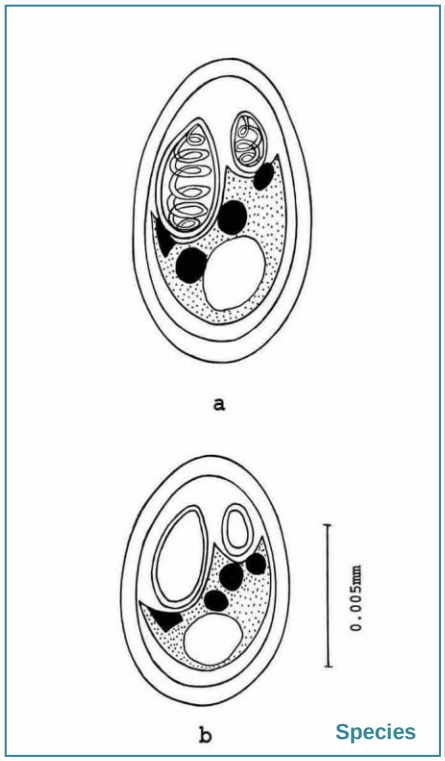

Figure 8
M. saranae (Gupta and Khera, 1991)
a & b. Spore stained in Ziehl-Neelsen (Valvular view)

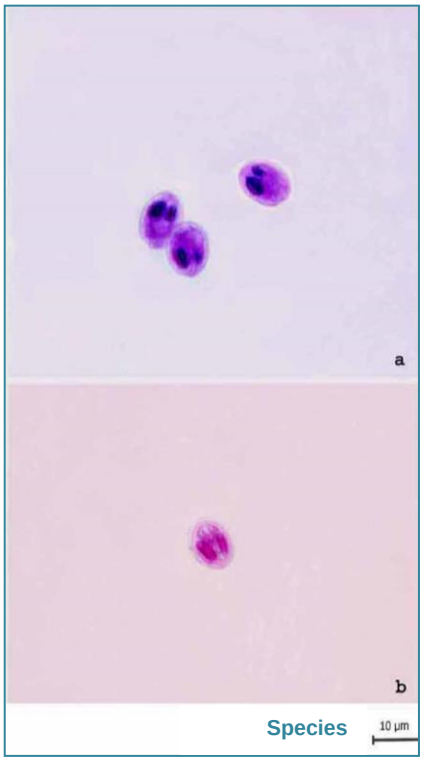

Figure 9
M. saranae (Gupta and Khera, 1991)
a & b. Spore stained in Ziehl-Neelsen

3.5. SP. IV: *M. saranae* Gupta and Khera (1990) (Figures. 8ab; 9ab)

3.5.1. Plasmodia

Very small, white, present on the caudal fin and measure 0.8-0.9 mm in diameter. 10-12 spores are present per plasmodium.

3.5.2. Spore description

(Measurements based on 8-9 spores in frontal view), (Table 7)
The spores are histozoic, measure 8.5x6.0µm, oval in valvular view having rounded anterior as well as posterior ends. Anterior end is slightly narrower than the posterior end. Shell valves are thick, smooth, symmetrical and measure 0.6µm in thickness. Parietal folds are absent. Polar capsules are two, unequal, oval to pyriform and slightly converge towards the anterior end. Both are bluntly pointed anteriorly and rounded posteriorly. The larger polar capsule measure 4.27x2.61 µm occupying almost half and the smaller one measure 2.2x1.94 µm occupying less than one third of the spore body cavity. Polar filaments form 5-6 coils in larger, 2-3 in smaller polar capsule and are arranged perpendicular to polar capsule axis. An intercapsular process is absent. Two capsulogenic nuclei measuring 0.5 µm in diameter are present beneath each polar capsule. Sporoplasm is agranular, homogenous occupying whole of the extracapsular space and contain two nuclei measuring 0.8-1.0 (0.9±0.14)µm in diameter. An iodniophilous vacuole is present measuring 3.0µm in diameter.

3.5.3. Taxonomic summary of *M. saranae* Gupta and Khera (1990)

Host: *Labeo rohita* (Ham.) vern. rohu
Locality: Kanjali wetland, Punjab, India
Site of infection: Caudal fin
Prevalence of infection: 13% (02/15)

3.5.4. Remarks

The present observations (LS/WS: 1.4) on *M. sarane* Gupta and Khera (1990) were in conformity with the original description (LS/WS: 1.2) except some variations in the size of the spore and polar capsules (as indicated by LS/WS ratio). An intercapsular process and parietal folds were also absent in the present species as in original specimens. Earlier, the parasite was recorded from gills of *Labeo calbasu* and *Puntius saranae* in Punjab (India). A new host- *L. rohita,* a new location- gill lamellae and a new locality- Kanjali wetland has been recorded for this parasite (Table 8).

The present observations (LS/WS: 1.1) on *M. filamentosus* (Haldar et al. 1981) Gupta and Khera, 1988 were in conformity with the original description (LS/WS: 1.4) except some variation in the size of spore (as indicated by LS/WS ratio). Parietal folds and intercapsular process were absent in the present species as in the original specimens. Spores were smaller in the present species. Gupta and Khera (1988) while transferring this species from *Myxosoma* to genus *Myxobolus* wrongly named it as *Myxobolus filamentosa*. Landsberg and Lom (1991) further emended the species as *Myxobolus filamentosus.* Earlier, this parasite was recorded in cartilage and brain of *Puntius filamentosa* in West Bengal (India). A new host- *Labeo calbasu,* a new location- scale and a new locality- Kanjali wetland are recorded for this parasite (Table 6).

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